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| **Lesson Title: The Greenhouse Effect** |
| **Subject area / course / grade level: 4th grade** |
| **Introduction: The sun is absorbed at different levels due to the different types of surface materials. The temperature can be observed to change with different types of surface material and color.** |
| **Lesson Length: 2-60 minute blocks** |
| **Materials:**   * **Interactive Science Notebook** * **Pencil** * **Large shoe box for each group of 4** * **Green and black construction paper** * **Thermometer** * **Stopwatch** * **Plastic wrap** * **Few rocks, and sticks for each group** * **Bowl of water** * **Temperature and time record sheet** * **Large white boards –one per group** |
| **Lesson Overview: This activity allows students to construct a simple model of the Earth's surface and lower atmosphere to illustrate the Greenhouse Effect, and to examine how different surface materials absorb different amounts of solar radiation.** |
| **Tennessee Standards:**  **GLE 0407.Inq.1 Explore different scientific phenomena by asking questions, making logical predictions, planning investigations, and recording data.**  **GLE 0407.Inq.2 Select and use appropriate tools and simple equipment to conduct an investigation.**  **GLE 0407.Inq.3 Organize data into appropriate tables, graphs, drawings, or diagrams.**  **GLE 0407.Inq.4 Identify and interpret simple patterns of evidence to communicate the findings of multiple investigations.**  **SPI 0407.Inq.1 Select an investigation that could be used to answer a specific question.**  **SPI 0407.10.1 Identify different forms of energy, such as heat, light, and chemical.**  **SPI 0407.10.2 Determine, which surfaces reflect, refract, or *absorb light*.** |
| **Lesson objective(s):**   * **TLW construct a model of the Earth and lower atmosphere using a shoebox and plastic wrap.** * **TLW hypothesis what the temperatures will do with green, black construction paper, and when water is added to the model.** * **TLW collect, observe, record, and analyze data of their experiment.** |
| **ENGAGEMENT**   * **Open a whole group discussion through questions:**   + **Ask students how they feel on a hot summer day? When does a summer day cool down? Does it have anything to do with the amount of clouds? What does it feel like when you wear a white shirt compared to a black shirt?**   + **Then discuss where does the energy, which warms Earth’s lower atmosphere, come from? Also discuss the solar energy is known as radiant energy? Also ask if temperature is different around the lake or the ocean?** * **Now have the students construct their boxes by placing green construction paper around the inside. Also have them collect a few small rocks and twigs.** |
| **EXPLORATION**   * **As a whole group follow the Scientific Method Student Guide. The students will write in their interactive science notebooks the procedure, three different hypothesis, materials, procedures, observations, and conclusions. They will also have a time and temperature data collection record to glue into their notebook.** * **In groups of four (timer, observer, recorder, and temperature reader), each student will have a specific job to complete for each surface area. The three surface areas are green construction paper, black construction paper, and bowl of water on green or black.** * **The students will then graph their data onto a line graph onto graph paper.** |
| **EXPLANATION:**   * **Each student will discuss in small groups their observations. They will analyze their data and write down any patterns they have seen.** * **Then each group will write down on large white boards what they observed.** * **Finally, the students will share their results with whole group. Whole group discussion of results.** |
| **ELABORATION:**   * **Then each student will develop a conclusion based on their results and write down in their notebooks.** |
| **EVALUATION**:   * **Each student will write a reflection of his or her learning. The reflection will show if the learner understood the concept.** * **Each student will be asked to develop a hypothesis for other surface areas. For instance, blue paper, yellow paper, hot bowl of water, and metal.** |